Severe Convection Forecasting and Warning Professional Development Series

Executive Producer: Ed Mahoney

Warning Decision Training Branch

Purpose: The goals of this PDS are twofold. Firstly, it outlines the scientific process and suggested effective job tasks and methodologies that are employed in the convective forecast and warning process. These methodologies can be used to help improve skills in decision making and lead to better service in the NWS public warning and forecast program. Secondly, the PDS provides a guide to all current convective related training material which addresses specific job skills, knowledge, and abilities for National Weather Service employees tasked with issuing convective weather warnings. This PDS was developed by a team of NWS SOOs, NSSL researchers, and NWS training representatives.

2002 Convective PDS Training Team present at March 6-7, 2002 meeting:

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Tony Mostek, NWS COMET Branch/VISIT leader, Scott Bachmeier, CIMSS/VISIT, Jon Davies, KSNW-TV and Exploration Place

A summary of the Professional Competency Units (PCUs) defined by the PDS Team

PCU 1 - Optimizing office strategies
PCU 2 - Assessing climatology
PCU 3 - Assessing the synoptic scale environment
PCU 4 - Assessing the mesoscale environment
PCU 5 - Analyzing structure of convective storms
PCU 6 - The Warning Decision
PCU 7 - Composing and Disseminating
PCU 8 - Monitoring
PCU 9 - Post-Event Assessment

PCU 1: Optimizing Office Strategies for Convective Warning Operations

Producer: Karl Jungbluth, SOO, DMX

Description of Job Duty Competency to be Achieved:

Configure and utilize all resources to enable the issuance of timely and accurate convective warnings (warning coordinator duties).

Description of Need:

To ensure appropriate resources are allocated to respond to the challenges of convective warning operations, the severe weather forecast “Team” must have an effective severe weather operations plan.

Specific Job Task Skills and Knowledge:

1. Ensure that all operational equipment (generator, hardware components, software, components, communication systems) is functioning at optimum levels.

2. Review office severe weather checklist at least 24 hours before an expected event.

3. Review service backup plan to ensure minimal transition time is lost in case emergency backup operations are necessary.

4. Check staffing to ensure that an adequate number of experienced (and fully trained) personnel is available to work the severe weather event.

5. During the event, the warning coordinator should maintain a high level of situational awareness with respect to the following:

    a. office communication of information internally and externally (to users)

    b. staffing (are all positions assigned and sufficiently alert staff available for the duration of the event?)

    c. effects of the mesoscale environment on the nature of the severe weather and associated warnings (how is the severe weather event unfolding?)

    d. operational systems (monitoring timely receipt of AWIPS products, and assuring products are being disseminated properly)

Instructional components:

1.1. Review your office's Station Duty Manual section on severe weather operations.

1.2. Review a training web page (to be developed) showing suggested staffing strategies for severe weather (Karl Jungbluth).

Recommended Readings:

(This is a place for any published and/or unpublished operational research material which might provide additional information and education opportunities on related subject matter areas in the PCU.)

Implementation and Evaluation tasks:

At each office, the SOO, WCM or severe weather focal point, will be assigned responsibility for updating the local Station Duty Manual section on severe weather operations.

PCU 2: Assessing Climatology

Producers: Jim LaDue and Brad Grant, WDTB

Description of Job Duty Competency to be Achieved:

Apply a knowledge of regional climatology to create a set of expectations for convective events.

Description of Need:

As a part of forecasting severe convection and issuing subsequent successful warnings, forecasters should know the range of possible atmospheric phenomena associated with current observations. Understanding regional and local climatological data helps to raise forecasters' awareness levels when assessing the environmental conditions for any given day. Offices should have a complete set of local climatological data that should be readily accessible to forecasters. These data should include known local effects of land and/or water on the atmospheric processes of severe convection.

Specific Job Task Skills and Knowledge

1. Know how current or anticipated data relate to the climatological distribution of convective events.

    a. Describe the regional (1) areal distribution, and (2) frequency of occurrence of thunderstorms (both severe and nonsevere, hourly, daily, monthly, and seasonal

variations) and how that distribution/frequency relates to the local County Warning Area (CWA).

b. As in (a) above, except specifically for tornadoes, including F-scale distribution and frequency.

c. Be cognizant of the weather patterns associated with any major tornado outbreaks that have previously affected the CWA.

d. As in (c), except for bow echoes, derechos, and flash flooding.

2. Know the limitations of using climatology in forecasting severe weather.

3. Know the local response (created by geography and regional topography) to synoptic and mesoscale features (such as ridges, troughs, low-level jets, cyclones, sea breeze fronts, and other boundaries) in order to assess the resulting potential for severe convection.

4. Assess potential frequency and limits to the degree of severity of convection in the forecast area as based on documented local extreme events. (rarity of events)

5. Use a knowledge of climatological patterns in your region to assist in the forecast expectations of severe convection.

6. Create an easily accessible database of local climatological data for forecaster reference. (Focal points only).

7. Compare synoptic scale systems to climatological “averages” (similar to forecasting rarity of events).

Instructional Components

2.1. NSSL’s Severe Thunderstorm Climatology (Know how to use it).

2.2. SPC's climatological web site. (Use it daily to see what has occurred in the past -- note it's a rough log.)

2.3. “Climatological Risk of Strong and Violent Tornadoes in the United States” (an AMS conference paper available at this web site.)

2.4. Importance of Climatology: “How to develop a severe weather climatology”, a web site by NWSTC showing available resources for the purpose of developing a severe weather climatology.

2.5. Local Application: Examples showing how climatological data can be applied to the forecasting of severe weather - NWSTC web site list of sources.

2.6. Local Application: An example of how one might assess climatological data prior to a severe weather event is found in the pre-briefing section of the WDTB WES simulation guides (see this WDTB WES web site).

2.7. Severe Weather Warning Methodologies. A distance learning training package that is proposed by WDTB for FY03. The objectives for this training are to provide forecasters with a systematic method for formulating successful convective storm warnings for various storm phenomena using the integrated convective warning process.

Recommended Readings:

1. An example of a local WFO severe weather climatology from a recent CR Tech Memo

2. SPC publications

3. WFO Quad-Cities Climatology of Severe Weather

Implementation and Evaluation Task 2.1:

At each office, the SOO or Climate focal Point will be assigned responsibility for ensuring that local climatological data are readily available to forecasters.

Implementation and Evaluation Task 2.2:

A focal point should develop unique local cases or create other exercises that allow forecasters to demonstrate their knowledge of the most important local effects on severe convection.

PCU 3: Assessing the Synoptic Scale Environment: Identifying Patterns and Synoptic Scale Features

Producer: Mike Vescio, SOO, FWD (with support from Steve Weiss, SOO, SPC)

Description of Job Duty Competency to be Achieved:

Assess the synoptic environment to determine if current (or future) large scale processes and patterns are favorable for severe convection. The goal is the development of the hazardous weather outlook.

Description of Need:

As a part of forecasting severe convection and issuing subsequent warnings, forecasters should perform a 4-D analysis/assessment of the synoptic scale environment to determine the influence that it will have on the likelihood of severe convection in their region. By doing this 4-D analysis/assessment, forecasters will achieve an understanding of the physical processes and interrelationship of the synoptic scale parameters (including limiting factors) for determining the severe weather potential.

Specific Job Task Skills and Knowledge:

1. Using a knowledge of severe convective patterns, perform an analysis of initial synoptic scale data to evaluate the potential for severe convection in your region.

    a. Diagnose the current state of the atmosphere by analyzing regional RAOBs in order to assess buoyancy, vertical wind shear, and other convective parameters.

    b. Analyze surface and upper air data for the presence of salient features such as shortwave troughs, thermal troughs, low level thermal/moisture axes, mid level dry intrusions, upper and lower level jet streaks, and static stability.

    c. Use the above to evaluate buoyancy, vertical wind shear, and convective parameters.

    d. Using compositing techniques, superimpose salient features listed above.

    e. Understand the significance of the particular juxtaposition of these features to severe thunderstorm development.

    f. Know how to utilize remote sensing data to augment “initial conditions.”

2. Using a knowledge of severe convective patterns and known model biases, perform an integrated 4-D analysis of future (or expected) synoptic parameters to evaluate the large scale threat of severe convection in your region in the next 12 hours.

    a. Evaluate changes in convective potential using numerical model data.

    b. Determine expected (or forecast) sounding/hodograph parameters based on modifying the sounding using gridded model data.

3. Forecast general type of severe weather based on evaluation of patterns and parameter values.

Instructional Components:

3.1. RTM-230 Skew-T Log P Diagram and Sounding Analysis (Available for download

from this NWSTC web site.)

3.2. Synoptic Pattern Database: The NWSTC has a limited database of synoptic scale patterns associated with severe thunderstorm occurrence (tornadic outbreaks, derechos, MCSs, etc.). This database will serve to improve pattern recognition skills of specific severe weather types.

3.3. Associate Parameter Values: The NWSTC has a limited database of parameter values associated with severe convection. This database will also describe the physical processes associated with these parameters (an ingredients based parameter evaluation approach to diagnostic severe weather forecasting). (This instructional component needs to be updated for regional patterns)

3.4. Developing a Regional Outlook: The NWSTC has a training module that describes how the patterns and parameters can be used to develop an outlook of severe weather potential for the 12 to 36 hour period.

3.5. Capabilities of Kinematic and Thermodynamic Severe Weather Parameters: A web site developed by WDTB for the FY03 Distance Learning Operations Course. This web site describes the capabilities of the latest thermodynamic and kinematic parameters for the short term prediction of severe convection. This site will include computational definitions (platform dependent), and strengths and limitations of various parameters such as CAPE, CIN, LCL height, shear, SRH, EHI, VGP, and more.

3.6. Severe Weather Warning Methodologies. A distance learning training package that is proposed by WDTB for FY03. The objectives for this training are to provide forecasters with prescribed methods and examples for formulating successful convective storm warnings for various storm phenomena using the integrated convective warning process.

Recommended Readings:

1. Basic Convection I: A Review of Atmospheric Thermodynamics. A hard copy document developed by the WSR-88D Operational Support Facility - Operations Training Branch (Module 3), 1991 (Limited copies available on request).

2. Severe Convective Storms - An Overview: a monograph by Chuck Doswell published by the AMS, 2001 (available on the web at this site).

3. “Overview of Environmental Conditions and Forecast Implications of the 3 May 99 Tornado Outbreak” (a SPC paper available at this web site).

4. “How to graphically develop and depict the Hazardous Weather Outlook (HWO)”: A paper by personnel at the Melbourne Forecast Office, is available a this web site.

5. Many SPC publications available at their published paper's web site.

6. Evans, Jeffery S., Charles A. Doswell III, 2001: Examination of Derecho Environments Using Proximity Soundings. Weather and Forecasting: Vol. 16, No. 3, pp. 329-342.

7. Johns, R. H., 1993: Meteorological conditions associated with bow echo development in convective storms. Wea. Forecasting., **8**, 294-299

8. Johns, R.H. and Hirt, W. D., 1987: Derechos: Widespread convectively induced windstorms. Wea. Forecasting., **2**, 32-49.

9. Johns, R.H. and Doswell III, C. A., 1992: Severe local storms forecasting. Wea. Forecasting., **7**, 588-612.

10. Rasmussen, Erik N., David O. Blanchard, 1998: A Baseline Climatology of Sounding-Derived Supercell and Tornado Forecast Parameters. Weather and Forecasting: Vol. 13, No. 4, pp. 1148-1164.

11. Thompson, R. L., 1998: Eta Model storm-relative winds associated with tornadic and nontornadic supercells. Wea. Forecasting., **13**, 125-137

12. A portion of each of the pre-briefing section in the Weather Event Simulation Guides deals with synoptic scale assessment. These sections can be used as good examples of analyzing the pre-storm synoptic scale environment.

13. The NWSTC bibliography of severe weather synoptic scale patterns and parameters has many good papers listed.

14. Read this good description of the **Hazardous Weather Outlook** (HWO) product produced by the NWS Wichita Forecast Office, available at this web site.

Implementation and Evaluation Tasks:

Evaluations are achievable via one-on-one WES training sessions using the Interval or Situational Awareness simulation methods.

PCU 4 : Analyzing and assessing the mesoscale environment

Producer: Brad Grant, WDTB

Description of Job Duty Competency to be Achieved:

Monitor the mesoscale environment to anticipate and identify storm type, storm evolution, and hazardous weather threat that will occur in the 0 to 6 hour period.

Description of Need:

Identifying important features in the severe convective mesoscale environment (including near-storm environment) enables the forecaster to focus on specific threat areas and specific storms within the CWA. Moreover, assessing the spatial and temporal evolution of the mesoscale convective environment can improve decision making skills by allowing the warning forecasting to better judge the potential severity and anticipated severe thunderstorm type (supercell tornado-producing, supercell hail-producing, damaging wind, or flash flood producer, etc.).

Specific Job Task Skills and Knowledge:

1. Determine buoyancy and shear related characteristics of the mesoscale environment for the purpose of anticipating potential convective storm types, through the use of upper air observations and model output (i.e., hodographs and Skew-T diagrams).

2. Apply conceptual models of cloud microphysics, convective mesoscale processes, and storm life cycles, for the purpose of identifying convective storm types and associated hazardous weather threats in the 0-6 hr. time frame.

3. Using all available in-situ and remote-sensing observational data, numerical model data, and SPC guidance, maintain a high level of situational awareness with respect to the evolution of mesoscale boundaries, buoyancy fields, vertical wind shear profiles, storm movements/interactions, and existing watches, warnings, and advisories.

4. Evaluate convective initiation aspects in your CWA (i.e., potential timing and location)**.**

Instructional Components:

4.1. WDTB Distance Learning Operations Course IC 5.7: *Convective Storm Structure and Evolution*. This training covers the fundamentals of convection, parameter evaluation and the propagation and evolution of convective storms. The production and detection of severe weather hazards such as hail, damaging wind, and

tornadoes are covered in Lesson 3 of the training. Student Guides are available for viewing and or downloading at this web site. This IC requires a 6 hr. teletraining session (2 days) that utilizes the new 200 page Student Guide. There are also review exercises for IC 5.7 (see Distance Learning Operations Course (DLOC) - Main Page).

4.2. Anticipating Convective Storm Type: The Use of Observed and Model Data for Prognostic Soundings to Assess Changes in Buoyancy and Shear. (A web module by WDTB of 3 different cases demonstrating the use of observed and model soundings for forecasting changes in storm type.)

4.3. Using Near-Storm Environment Data in the Warning Decision Making Process (IC 9.6 of the IST PDS).

4.4. Mesoscale Analysis of Convective Weather Using GOES RSO Imagery (IC 7.4.3 of the IST PDS).

4.5. A Convective Storm Matrix: Buoyancy/Shear Dependencies (CD-ROM available from COMET).

4.6. Anticipating Convective Storm Structure and Evolution (CD-ROM available from COMET).

4.7. An MCS Matrix Including MCS: Squall Lines and Bow Echoes (CD-ROM available from COMET).

4.8. COMET MCS Web site.

4.9. Forecasting Mesoscale Convective Systems: A teletraining session with speaker notes produced by WDTB and Wes Junker (HPC), which illustrates the complexities of forecasting MCSs. This session contains an exercise where the forecaster must answer questions on storm propagation and evolution.

4.10. Predicting Supercell Motion Using Hodograph Technique: COMET web cast that presents research findings and recommendations for a new, statistically superior method for anticipating supercell storm motion.

4.11. Downburst Prediction Module: A web module from WR and WDTB that summarizes research and operational applications of predicting downbursts.

4.12. Pre-brief sections of the WES Simulation Guides.

4.13. Boundary Detection and Convective Initiation: VISITview sessions on integrated remote sensing considerations for detecting and forecasting convective initiation.

4.14. A number of basic convection training materials developed for the Navy by

COMET (available at this web address).

4.15. A series of web based training modules on quantitative precipitation and flash flood forecasting (also listed in QPF PDS) available from this web site.

4.16. Severe Weather Warning Methodologies. A distance learning training package that is proposed by WDTB for FY03. The objectives for this training are to provide forecasters with a systematic method for formulating successful convective storm warnings for various phenomena using the integrated convective warning process.

Recommended Readings:

1. Erik Rasmussen's NSSL Tornado Research Page (available at this web site).

2. Denver Mesoscale Forecast Experiment, CR Applied Research Paper 16-07. (Available here)

3. Choose from many good papers from the SPC publications web site.

4. Choose from many good papers from the NWSTC Forecasting Severe Weather Bibliography.

5. Many new papers on convective storm evolution are documented on the reference guide and associated bibliography section of the DLOC Convective Storm Structure and Evolution Student Guide, pages 83-101. (available from this web site).

6. A Primer on Low Level Buoyancy Parameters when Assessing Tornadic Supercell Environments (web page by Jon Davies).

7. An Overview of a Cool Season Tornado over Central Mississippi (case study web paper by Alan Gerard, NWS JAN).

8. Mesoscale Interactions Triggering Severe Thunderstorms and Flash Flooding in Southwestern California July 1999: WR Technical Attachment, available at this web site.

Implementation and Evaluation Tasks:

Evaluations are achievable via one-on-one WES training sessions using the Interval or Situational Awareness simulation methods.

PCU 5: Analyzing structure of convective storms to assess storm intensity and evolution

Producer: Jim LaDue, WDTB

Description of Job Duty Competency to be Achieved:

Determine the structure of convective storms to assess severe weather warning threat.

Description of Need:

To determine which storms will be considered for warnings, a forecaster needs to interrogate the four dimensional attributes of each storm.

Specific Job Task Skills and Knowledge:

1. Analyze storm structure and determine any associated hazardous weather using WSR-88D output (base data and algorithms) and other observational data.

2. Analyze the four dimensional evolution of convective storms using all available data sources.

Instructional Components:

5.1. DLOC Instructional Component 5.7: C*onvective Storm Structure and Evolution*. See section on *Radar Evaluation of Severe Storms* (Lesson 3). See description of IC 4.1.

5.2. DLOC workshop (Available for DLOC students only). (See description at this web site).

5.3. Tornado Warning Guidance 2002: The WDTB has provided a training package that is intended to help forecasters utilize the latest scientific findings, technology, and the human element in formulating more effective tornado warnings. The training is composed of three elements: 1) Tornado Warning General Guidance, 2) Radar Algorithm Statistics from NSSL study, and 3) a Teletraining session providing real-time examples and summarizing some of the most important points in the TWG document.

5.4. WES simulations and simulation guide material (available at this web site).

5.5. SCAN Training (Student guide available for viewing or playback from this WDTB web site).

5.6. Severe Weather Warning Methodologies. A distance learning training package

that is proposed by WDTB for FY03. The objectives for this training are to provide forecasters with a systematic method for formulating successful convective storm warnings for various storm phenomena using the integrated convective warning process.

5.7. Anticipating Convective Storm Structure and Evolution (CD-ROM available from COMET).

Recommended Readings:

1. Basic Convection II: A hard copy document developed by the WSR-88D Operational Support Facility - Operations Training Branch, 1994 (Limited copies available upon request).

2. Several good papers listed in the Reference section (Appendix A) from the DLOC IC 5.7 Student Guide.

3. The WSR-88D Operator's Guide to Mesocyclone Recognition and Diagnosis (OSF, 1995, 111 pp). This Guide is a large, spiral-bound manual that is PUP-based but still contains some important Doppler radar recognition principles that are valid with 88D products on AWIPS. (Limited copies available on request)

4. Mesocyclone Characteristics of Mini Supercell Thunderstorms (AMS WAF paper, 1996). (Available at this web site.)

5. Elements of a Strong and Successful Severe Weather Program (ER web site)

Implementation and Evaluation Tasks:

Evaluations are achievable via one-on-one training sessions using the Interval or Situational Awareness simulation methods.

PCU 6: The Warning Decision

Producer: John Ferree, WDTB

Description of Job Duty Competency to be Achieved

Integrate all relevant information and apply situational awareness to make appropriate warning decisions.

Description of Need

Forecasters must make warning decisions which protect life and property and elicit appropriate public response.

Specific Job Tasks, Skills, and Knowledge

1. Be familiar with and consequently apply the methodology of issuing warnings.

2. Using all available observational data, identify the severe weather threats (hail, wind, tornadoes, flash flooding) and the locations where the threat is imminent.

3. Be able to acquire spotter reports, determine their value, and assimilate them into the decision making process.

4. Provide the appropriate interaction with emergency managers as well as law enforcement officials to determine or convey the severe weather threat.

5. Identify decision making styles and their impact on proper decision making.

6. Identify the characteristics of team decision making and coordination, and the impacts of associated breakdowns.

7. Identify the characteristics of situation awareness and their impact on the warning decision. Be able to incorporate sound situation awareness into the decision on whether or not to warn.

8. Be able to configure workstation to aid in providing and maintaining a good situation awareness.

Instructional Components:

6.1. WDM III Workshops: Several excellent presentations currently available for download at this WDTB web site.

6.2. Severe Weather/Flash Flood Warning Decision Making Workshops: Presentations are available for downloading.

6.3. Weather Event Simulator (WES) Cases: Simulation guides available at this web site.

6.4. Severe Weather Warning Methodologies. A distance learning training package that is proposed by WDTB for FY03. The objectives for this training are to provide forecasters with a systematic method for formulating successful convective warnings for various storm phenomena using the integrated convective warning process.

Recommended Readings:

Implementation and Evaluation Tasks:

Evaluations are achievable via one-on-one WES training sessions using the Interval, Situational Awareness, or VR (guided) simulation methods.

PCU 7 : Composing and Disseminating the Convective Warning Product(s)

Producer: TBD

Description of Competency to be Achieved

Using WARNGEN, effectively configure, compose and disseminate warnings to accurately convey storm threat. This process must follow standardized NWS Operations Manuals.

Description of Need

Forecasters must communicate and coordinate a complete, accurate and timely warning message to affect the desired response from the user community.

Specific Job Task Skills and Knowledge:

1. Utilize WARNGEN to accurately define warning area(s)

2. Compose warnings and statements as specified in WSOM Part C, Chapter 40, Severe Local Storm Watches, Warnings and Statements.

3. Disseminate warnings and statements as specified in WSOM Part C, Chapter 66Dissemination of Public Warnings

4. Use effective wording of warnings and conduct proper dissemination process to user community.

Instructional Components:

7.1. Use the WES in real-time mode to practice issuing warnings using WARNGEN.

Recommended Readings:

1. AWIPS User's Manual for Release 5.0, Section 4 Text Generation and Display and Section 5 Warning Generation.

2. WSOM Part C, Chapter 40 Severe Local Storm Watches, Warnings and Statements and associated OMLs/ROMLs. WSOM Part C, Chapter 66 Dissemination of Public Warnings and associated OMLs/ROMLs.

Implementation and Evaluation Tasks:

A competency drill will be designed to assess forecaster proficiency in issuing warning products (achievable via the WES real-time Simulation mode).

PCU 8: Monitoring the Convective Warning Operations

Producer: Brad Grant

Description of Job Duty Competency to Be Achieved:

Monitor all sources of data (mesoscale, stormscale, spotters, etc.) to provide a continuous stream of information to the users about the changing nature of the severe weather threat (SVS, LSR, NOW). In addition, reassess office strategies (PCU#1) and make adjustments as needed.

Description of Need:

Users require frequent reaffirming information on the detailed nature of the severe weather threat in order to take appropriate action. The staff needs to maintain situation awareness of all storm threats in the CWA.

Specific Job Task skills and Knowledge:

1. Issue Severe Weather Statements (SVS), Local Storm Reports (LSR), and Short Term Forecasts (NOW) frequently to update severe weather event-driven products (SVR, TOR, FFW).

2. Determine the evolution (especially demise) of convective storm threats.

Instructional Components:

8.1. Use the WES (Virtual Reality simulation mode) to issue products that convey the ongoing level of threat.

8.2. Severe Weather Warning Methodologies. A distance learning training package that is proposed by WDTB for FY03. The objectives for this training are to provide forecasters with prescribed methods for formulating successful convective storm warnings for various storm phenomena using the integrated convective warning process.

Recommended Readings:

1. Real-Time Monitoring and Reconstruction of a Severe Thunderstorm Environment Using Unique Data Sets: A Central Region Technical Attachment (Available at this web site).

Implementation and Evaluation Tasks:

Evaluations are achievable by via one-on-one training sessions with the WES Trainee and Trainer using the Virtual Reality Simulation method.

PCU 9: Post-Event Assessment

Producer: Liz Quoetone, WDTB (with help from Steve Brueske, MIC, GTF)

Description of Job Duty Competency to be Achieved

Evaluate convective-based events with regard to the science, technology, and human factors contributions to the successes or failures during the event.

Description of Need

It is only by understanding the impacts of these factors that successes can be built upon, and failures can be understood and potentially mitigated.

Specific Job Task Skills and Knowledge

1. Evaluate the impact and performance of the available technology including:

    a. Remote sensing tools and automated guidance for the event. This would include availability, reliability, and applicability of information provided by radar, model analysis and forecasts, mesoscale data and analysis, satellite, lightning, etc.

    b. Availability and usefulness of other office technologies including hardware and software associated with workstation usage, dissemination, and communications.

2. Evaluate the applicability of scientific findings during the event. This would include the use and value of conceptual models, as well as their correct application.

3. Evaluate the impact of human factors related issues to include:

    a. Staffing (experience and amount)

    b. Communication and coordination within the warning team and with partner organizations

    c. Product timeliness, correctness, and effectiveness

    d. Office strategies including duties, equipment layout, procedures

    e. Situation awareness (ability to perceive, comprehend and project data into meaningful expectations)

    f. Training

4. Gather, document, and validate ground truth reports. This would include:

    a. Conducting damage surveys as deemed appropriate.

    b. Performing post-storm analysis to validate report times and locations.

5. Evaluate impacts of products issued.

Instructional Components:

TBD

Implementation and Evaluation Tasks:

TBD